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# टेलीविज़न और ध्वनि संकेतों के लिए केबलकृत वितरण तंत्र—विशिष्टि

## भाग 4 निष्क्रिय समाक्ष वाइडबैंड वितरण संघटक

*Indian Standard*

# CABLED DISTRIBUTION SYSTEMS FOR TELEVISION AND SOUND SIGNALS — SPECIFICATION

## PART 4 PASSIVE COAXIAL WIDEBAND DISTRIBUTION COMPONENTS

UDC 621·397·743 : 621·396·6

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

*March* 1995

Price Group 3

Radio Communications Sectional Committee, LTD 20

## FOREWORD

This Indian Standard ( Part 4 ) was adopted by the Bureau of Indian Standards, after the draft finalized by the Radio Communications Sectional Committee had been approved by the Electronics and Telecommunication Division Council.

The series of standards on cabled distribution system for television and sound signals comprise of the following parts:

| | |
|---|---|
| Part 1 | Safety requirements |
| Part 2 | Electromagnetic compatibility for system and components ( *under prepration* ) |
| Part 3 | Active coaxial wideband distribution components |
| Part 4 | Passive coaxial wideband distribution components |
| Part 5 | Headend |

This standard ( Part 4 ) identifies the performance requirements and lays down data publication requirements for certain parameters for passive coaxial wideband distribution components. It also stipulates methods of measurement for compliance testing and introduces minimum requirements defining quality grade(s). This standard is largely based on IEC document 12G ( Sectt ) 130 'Cabled distribution system for television and sound signals: Part 4 Passive coaxial wideband distribution components'.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values ( *revised* )'. The number of significant places retained in the rounded off values should be the same as that of the specified value in this standard.

*Indian Standard*

# CABLED DISTRIBUTION SYSTEM FOR TELEVISION AND SOUND SIGNALS — SPECIFICATION

## PART 4 PASSIVE COAXIAL WIDEBAND DISTRIBUTION COMPONENTS

### 1 SCOPE

**1.1** This standard applies to receiver leads, system outlets, splitters and subscriber's taps, passive one and two port devices comprising filters, attenuators, equalizers, galvanic isolators, power injectors, cable splices, terminating resistors and delivery points in the frequency range 5 MHz to 1 750 MHz.

NOTES

1 There are two grades for taps and splitters and passive one-and-two port devices. This enables the system designer to optimize cost/performance, taking into account the size of the network and local circumstances.

2 There is only one grade of system outlet and receiver lead. Different networks require the same performance and, when integrating networks, upgrading will be avoided.

### 2 REFERENCES

The Indian Standards listed in Annex A are necessary adjuncts to this standard.

### 3 TERMINOLOGY

For the purpose of this standard, the following definitions shall apply.

**3.1 Feeders**

**3.1.1** *Feeder*

A transmission path forming part of a cable distribution system. Such a path may consist of a metallic cable, optical fibre waveguide, or any combination of them. By extension the term is also applied to paths containing one or more radio links.

**3.1.2** *Spur Feeder*

A feeder to which subscribers' taps or looped system outlets are connected.

**3.1.3** *Subscriber's Feeder*

A feeder connecting a subscriber's tap to a system outlet or, where the latter is not used, directly to the subscriber's apparatus, in which case it may include filters and balun transformers.

**3.2 Distribution System Equipment**

**3.2.1** *Splitter (Spur Unit)*

A device in which the signal energy at the (input) port is divided equally or unequally between two or more (output) ports.

NOTE – Some forms of this device may be used in the reverse direction for combining signal energy .

**3.2.2** *Directional Coupler*

A splitter in which the attenuation between any two output ports exceeds the sum of the attenuations between the input port and each of those output ports.

**3.2.3** *Equalizer*

A device designed to compensate over a certain frequency range the amplitude/frequency distortion or the phase/frequency distortion introduced by feeders or equipment.

NOTE – This device is for the compensation of linear distortion only.

**3.2.4** *Subscriber's Tap*

A device for connecting a subscriber's feeder to a spur feeder.

**3.3 Subscriber Related Equipment**

**3.3.1** A device for interconnecting a subscriber's feeder and a receiver lead.

**3.3.2** *Looped System Outlet*

A device through which the spur feeder passes and to which is connected a receiver lead, without the use of a subscriber's feeder.

**3.3.3** *Receiver Lead*

A lead which connects the system outlet to the subscriber's apparatus.

NOTE – It may include filters and balun transformers in addition to the cable.

**3.4 Characteristics of the Signal**

**3.4.1** *Decimal Ratio*

The decimal ratio of two quantities of power $P_1$ and $P_2$ is defined by:

$$10 \log P_1/P_2 \text{ (dB)}$$

**3.4.2** *Attenuation*

Attenuation of any system is the decimal ratio of the input power to the output power.

### 3.4.3 *Frequency Response*

The gain or loss of a system plotted against frequency.

## 3.5 Performance Characteristics

### 3.5.1 *Mutual Isolation*

The attenuation between one system outlet and another at any frequency within the range of the system under investigation. It is always specified, for any particular installation, as the minimum value obtained within specified frequency limits.

## 3.6 Miscellaneous

### 3.6.1 *Delivery Points*

A device, where responsibility for the network changes.

### 3.6.2 *Well-Matched*

A test set-up is said to be " well-matched" when the port or ports facing the equipment under test have a return loss ratio of at least 20 dB relative to the system impedance.

# 4 METHODS OF MEASUREMENT

**4.1** Measurements of attenuation, isolation, through loss and amplitude frequency response are basically measurements of insertion loss. Well established procedures exist and shall not be duplicated here.

**4.2** Returns loss ratio measurements shall be carried out as laid down in IS 14231 ( Part 3 ) : 1995. Unused ports shall be well-matched in 75 ohms.

# 5 PERFORMANCE REQUIREMENTS AND RECOMMENDATIONS

## 5.1 Safety

The safety requirements of all components shall conform to IS 14231 ( Part 1 ) : 1995 .

## 5.2 EMC

The limits of radiation and susceptibility to interference for all passive components covered by this standard are laid down in terms of their screening attenuation.

The screening attenuation shall not exceed 20 $\mu$V/m at a tuned dipole at 3 metres.

## 5.3 Environmental

Manufacturers shall publish environmental information on their products to enable users to judge their suitability with regards to four main requirements; storage, transportation, installation and operation.

The presentation of the information shall conform with the requirements of the following standards.

### 5.3.1 *Storage*

| | |
|---|---|
| Simulated effects of | IS 9001 (Part 14) : 1979. |

### 5.3.2 *Transportation*

| | |
|---|---|
| Air freight (combined cold and low pressure) | IS 9000 (Part 31) : 1978 |
| Road transport (bump test) | IS 9000 (Part 7/Sec 2) : 1985 |
| Road transport (shock test) | IS 9000 (Part 7/Sec 1) : 1985 |

### 5.3.3 *Installation or Maintenance*

| | |
|---|---|
| Drop and topple test | IS 9000 (Part 7/Sec 3) : 1985 |
| Free fall test | IS 9000 (Part 7/Sec 4) : 1985 |

### 5.3.4 *Operation*

Climatic category of component or equipment for storage and operation as defined in following standards:

| | |
|---|---|
| General | IS 9000 (Part 1) : 1988 |
| Cold | IS 9000 (Part 2/Sec 1 to 4) : 1977 |
| Dry heat | IS 9000 (Part 3/Sec 1 to 5) : 1977 |
| Damp heat | IS 9000 (Part 5/Sec 1 to 2) : 1981 |
| Vibration (sinusoidal) | IS 9000 (Part 8) : 1981 |

## 5.4 Impedance

The nominal impedance of all passive component shall be 75 ohms.

## 5.5 Markings

**5.5.1** Each component shall be legibly and indelibly marked with the following:

a) Manufacturer's name or trade-mark,
b) Serial number, and
c) Country of manufacture.

**5.5.1.1** It is recommended that appropriate symbols shall be used, when marking ports.

### 5.5.2 *BIS Certification Marking*

The components may also be marked with the Standard Mark.

**5.5.2.1** The use of the Standard Mark is governed by the provisions of the Bureau of Indian Standards Act, 1986 and the Rules and Regulations made thereunder. Details of conditions under which a licence for the use of the Standard Mark may be granted to manufacturers and producers may be obtained from the Bureau of Indian Standards.

## 5.6 Return Loss Ratio

Depending on quality grades, the return loss ratio of passive components shall fall within one of the categories given in Table 1.

**Table 1 Component Categories**

( *Clauses* 5.6 *and* 6.2.2 )

| Category | Requirements | | |
|---|---|---|---|
| A | 5 to 40 MHz | 22 dB<br>≥ 14 dB | – 1.5 dB/octave above 40 MHz<br>at 1 750 MHz |
| B | 5 to 40 MHz | 18 dB<br>≥ 10 dB | – 1.5 dB/octave above 40 MHz<br>at 1 750 MHz |
| C | 5 to 40 MHz | 14 dB<br>≥ 10 dB | – 1.5 dB/octave above 40 MHz<br>at 1 750 MHz |
| D | | ≥ 10 dB | from 5 to 1 750 MHz |

## 6 RECEIVER LEAD

### 6.1 Introduction

There is only one quality grade.

### 6.2 Electrical and Mechanical Parameters and Requirements

**6.2.1** *Connectors*

The connectors used on the receiver lead shall conform to IS 13696 : 1993.

**6.2.2** *Return Loss Ratio*

The return loss shall be up to category C requirements, as defined in Table 1.

**6.2.3** *Frequency Range*

The operation frequency range of the receiver lead shall be published.

**6.2.4** *Attenuation*

Attenuation of the receiver lead at the highest frequency of operation shall be published.

**6.2.5** *Sheath Colour*

The colour of the outer sheath insulation shall be published.

## 7 SYSTEM OUTLET

### 7.1 Description

System outlets can exist in two versions:

- for connecting to subscriber's feeder.
- looped system outlet.

There can be safety isolation incorporated in the system outlet, if local regulations require it.

### 7.2 Quality Grading

There is only one quality grade.

### 7.3 Mechanical Requirements

**7.3.1** The system outlet shall compatible with the conduit box used, which may be nationally or internationally standardised.

**7.3.2** The distance between the interface ports centres shall be 30 ± 0.5 mm.

### 7.4 Electrical Parameters and Requirements

For outlets with integral filters a deviation of 3 dB is permissible in the transition ranges for the return loss ratio and isolation requirements. Referred to the nominal cut-off frequency the transition range is defined as 8 MHz for TV and 4 MHz for radio.

**7.4.1** *Return Loss Ratio*

The minimum return loss ratio shall be:

| | *Grade* 1 |
|---|---|
| — input port | B |
| — output port (looped through only) | B |
| — TV interface port | C |
| — FM radio interface port | D |

In looped system outlets, the return loss at the input port shall be at least up to category D with the interface ports either open or short circuited.

**7.4.2** *Frequency Range*

The operating frequency range of the system outlet shall be published.

**7.4.3** *Losses*

The attenuation, and its tolerance, of the losses defined below shall be published.

**7.4.3.1** *Basic loss* – defined as the attenuation between input port and interface port.

**7.4.3.2** *Through loss* – defined as the attenuation between input port and output port (looped system outlet only).

**7.4.4** *Amplitude Frequency Response Flatness*

The flatness of the amplitude frequency response from the input port to all other ports shall be published.

Narrowband flatness to the output ports (looped-through only) shall be within 0.2 dBpp/0.5 MHz and 0.5 dBpp/7 MHz.

**7.4.5** *Mutual Isolation*

Looped system outlets shall provide directivity, to attenuate reflected signals which may cause echos and affect flatness.

Minimum directivity, defined as the attenuation between the output and interface port minus the attenuation between input and interface port, shall be :

At 40 MHz 18 dB −1.5 dB/octave above
40 MHz and up to 1 750 MHz

The values from 5 to 40 MHz shall be published.

**7.4.6** All system outlets shall meet the following requirements:

The minimum attenuation between TV and radio interface ports shall be 10 dB over the operating frequency range.

The minimum attenuation between broadband interface ports shall be 20 dB over the operating frequency range.

**7.4.7** Where filters are incorporated in the system outlet, the selectivity curves shall be published.

**7.4.8** *Chrominance/Luminance Delay Inequality*

The worst case delay inequality in nanoseconds, between the luminance and chrominance (4.43 MHz) within a single television channel, shall be published. The worst case channels shall be identified by frequency.

## 8 SPLITTERS AND SUBSCRIBER'S TAPS

### 8.1 Description

A subscriber's tap provides the principal isolation between subscribers. A tap contains, in addition to its input and output ports, one or more tap ports.

Subscriber's taps and splitters may incorporate AC or DC bypass.

There are two quality grades.

### 8.2 Mechanical Requirement

**8.2.1** *Connectors*

The type of cable connection used shall be published.

### 8.3 Electrical Parameters and Requirements

**8.3.1** *Return Loss Ratio*

The minimum return loss ratio shall be:

| | *Grade* 1 | *Grade* 2 |
|---|---|---|
| All ports | A | B |

The input port return loss ratio shall be at least up to category C when the tap ports are open or short circuited in the worst case combination.

**8.3.2** *Frequency Range*

The operating frequency range shall be published.

**8.3.3** *Losses*

The attenuation, and its tolerance, of the losses defined below shall be published.

**8.3.3.1** *Splitter loss* – defined as the attenuation between input port and output port/s.

**8.3.3.2** *Tap loss* – defined as the attenuation between input port and tap port/s.

**8.3.3.3** *Through loss (taps only)* – defined as the attenuation between input port and output ports.

**8.3.4** *Amplitude Frequency Response Flatness*

The flatness of the amplitude frequency response from the input to output and tap ports shall be published.

Narrowband flatness to output port shall be within 0.2 dBpp/0.5 MHz and 0.5 dBpp/7MHz.

**8.3.5** *Chrominance/Luminance Delay Inequality*

The worst case delay inequality, in nanoseconds, between the luminance and chrominance (4.4.3 MHz) within a single television channel, shall be published. The worst case channels shall be identified by frequency.

**8.3.6** *Hum Modulation*

Where the splitter or tap provides AC or DC bypass capability, the maximum permissible current and voltage, corresponding to 60 and 70 dB hum modulation shall be published.

**8.3.7** *Isolation*

Isolation is defined as the attenuation between output ports or tap ports.

**8.3.7.1** *Splitters*

The isolation shall be:

| *Grade* 1 | *Grade* 2 |
|---|---|
| A | B |

where A, B requirements are as laid down for Return Loss Ratio.

In the case of splitters with unequal output division the above requirement for isolation shall be increased by the difference in attenuation between the output ports.

**8.3.7.2** *Subscriber's taps*

The isolation from 5 to 47 MHz shall be 30 dB for quality Grade 1, the value for Grade 2 devices shall be published.

The directivity for quality Grades 1 and 2 shall be:

At 40 MHz 17 dB – 1.5 dB/octave above
40 MHz and up to 1 750 MHz

and 10 dB for Grade 1 from 5 to 40 MHz. For Grade 2 value shall be published from 5 to 40 MHz.

## 9 PASSIVE ONE-AND-TWO PORT DEVICES

**9.1** Passive devices with one or two basic ports are:

- delivery points
- power injectors
- cable splices
- galvanic isolators
- terminating resistors
- filters
- equalizers

There are two quality grades.

**9.2 Mechanical Requirement**

**9.2.1** *Connectors*

The type of cable connection used shall be published.

**9.3 Electrical Parameters and Requirements**

**9.3.1** *Return Loss Ratio*

The return loss ratio shall be

| | *Grade* 1 | *Grade* 2 |
|---|---|---|
| All ports | A | B |

For filters a deviation of 3 dB is permissible in the transition ranges. Referred to the nominal cut-off frequency, the transition range is defined as 8 MHz for TV and 4 MHz for radio.

**9.3.2** *Frequency Range*

The operating frequency range shall be published.

**9.3.3** The insertion loss shall be published.

**9.3.4** *Amplitude Frequency Response Flatness*

The flatness of the amplitude frequency response between input and output ports shall be published.

Narrowband flatness shall be within 0.2 dBpp/0.5 MHz and 0.5 dBpp/7MHz.

**9.3.5** *Chrominance/Luminance Delay Inequality*

The worst case delay inequality, in nanoseconds, between the luminance and chrominance (4.43 MHz) within a single television channel, shall be published. The worst case channels shall be identified by frequency.

**9.3.6** *Hum Modulation*

If the device provides AC or DC bypass capability, the maximum permissible current and voltage corresponding to 60 to 70 dB hum modulation shall by published.

## 10 SUMMARY OF SPECIFICATIONS TO BE PUBLISHED

**10.1 Splitters**

**10.1.1** *No. of Output Ports*

**10.1.2** *Circuit – Hybrid or Resistive*

**10.1.3** *Bandpass in* MHz

**10.1.4** *Insertion Loss in* dBs

**10.1.5** *Isolation Between Ports*

**10.1.6** *Type of Connectors*

**10.1.7** *Impedance*

**10.1.8** *Frequency Response Flatness*

**10.1.9** *Construction Details of Housing and its Material*

**10.1.10** *Size and Weight*

**10.2 Taps Off**

**10.2.1** *No. of Ports (Input, Output and Branch)*

**10.2.2** *Band Pass in* MHz

**10.2.3** *Frequency Response Flatness*

**10.2.4** *Tap Loss in* dB

**10.2.5** *Insertion Loss in* dB

**10.2.6** *Isolation Between Ports*

**10.2.7** *Return Loss in* dB

**10.2.8** *AC Current Passing Capacity in* amps

**10.2.9** *AC Hum Modulation in* dB

**10.2.10** *Circuit – Resistive or Hybrid*

**10.2.11** *Type of Connectors*

**10.2.12** *Impedance*

**10.2.13** *Construction Details of Housing and its Material*

**10.2.14** *Size and weight*

**10.3 Equalizers**

**10.3.1** *Band Pass in* MHz

**10.3.2** *Impedance*

**10.3.3** *Return Loss*

**10.3.4** *Tilt/Slope*

**10.3.5** *Type of Connectors*

**10.3.6** *Construction Details of Housing and its Material*

**10.3.7** *Size and Weight*

**10.4 Receiver Lead**

**10.4.1** *Impedance*

**10.4.2** *Type of Connectors*

**10.4.3** *Return Loss Ratio*

**10.4.4** *Band Pass in* MHz

**10.4.5** *Attenuation at Highest Frequency for which Designed*

**10.4.6** *Insertion Loss*

**10.4.7** *Colour of Sheath*

**10.5 Subscriber Taps**

**10.5.1** *Impedance*

**10.5.2** *Circuit – Hybrid or Resistive*

**10.5.3** *Band Pass in* MHz

**10.5.4** *Series Connection Facility or Loop Through*

**10.5.5** *End of Line Termination*

**10.5.6** *DC Block Arrangement*

**10.5.7** *Type of Connector*

**10.5.8** *Return Loss*

**10.5.9** *Construction Details of Housing and its Material*

**10.5.10** *Size and Weight*

## ANNEX A

( *Clause* 2 )

### LIST OF REFERRED INDIAN STANDARDS

| *IS No.* | *Title* |
|---|---|
| 9000 | Basic environmental testing procedures for electronic and electrical items: |
| (Part 1) : 1988 | Part 1 General |
| (Part 2/Sec 1-4) : 1977 | Part 2 Cold test, |
| | Section 1 General |
| | Section 2 Cold test for non-heat dissipating items with sudden change of temperature |
| | Section 3 Cold test for non-heat dissipating items with gradual change of temperature |
| | Section 4 Cold test for heat dissipating items with gradual change of temperature |
| (Part 3/Sec 1-5) : 1977 | Part 3 Dry heat test |
| | Section 1 General |
| | Section 2 Dry heat test for non-heat dissipating items with sudden change of temperature |
| | Section 3 Dry heat test for non-heat dissipating items with gradual change of temperature |
| | Section 4 Dry heat test for heat dissipating items with sudden change of temperature |
| | Section 5 Dry heat test for heat dissipating items with gradual change of temperature |
| (Part 5/Sec 1-2) : 1981 | Part 5 Dampheat (cyclic) test |
| | Section 1 16 + 8 h cycle |
| | Section 2 12 + 12 h cycle |
| (Part 7/Sec 1-4) : 1985 | Part 7 Impact test |
| | Section 1 Shock test |
| | Section 2 Bump test |
| | Section 3 Drop and topple test |
| | Section 4 Free fall test |
| (Part 8) : 1981 | Part 8 Vibration (sinusoidal) test |
| (Part 31) : 1978 | Part 31 Combined cold/low air pressure test |
| 9001 | Guidance for environmental testing: |
| (Part 14) : 1979 | Part 14 Storage test |
| 13696 : 1993 | Interconnection of radio and TV receivers |
| 14231 | Cabled distribution systems for television and sound signals: |
| ( Part 1 ) : 1995 | Part 1 Safety requirements |
| (Part 3) : 1995 | Part 3 Active coaxial wideband distribution components |

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Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition.

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**Amendments Issued Since Publication**

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|---|---|---|
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| | | |

BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones : 331 01 31, 331 13 75

Telegrams : Manaksanstha
( Common to all offices )

| Regional Offices : | Telephone |
|---|---|
| Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg<br>NEW DELHI 110002 | 331 01 31<br>331 13 75 |
| Eastern : 1/14 C. I. T. Scheme VII M, V. I. P. Road, Maniktola<br>CALCUTTA 700054 | 37 84 99, 37 85 61<br>37 86 26, 37 86 62 |
| Northern : SCO 335-336, Sector 34-A, CHANDIGARH 160022 | 60 38 43<br>60 20 25 |
| Southern : C. I. T. Campus, IV Cross Road, MADRAS 600113 | 235 02 16, 235 04 42<br>235 15 19, 235 23 15 |
| Western : Manakalaya, E9 MIDC, Marol, Andheri ( East )<br>BOMBAY 400093 | 632 92 95, 632 78 58<br>632 78 91, 632 78 92 |

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